THE FEEDBACK DYNAMICS BETWEEN POVERTY AND EDUCATION OPPORTUNITY: VICIOUS CIRCLE OF POVERTY

N. Gizem Bacaksızlar and Yaman Barlas

Boğaziçi University
Industrial Engineering Department
34342 Bebek Istanbul Turkey
+90 212 359 73 43
nbacaksi@uncc.edu, ybarlas@boun.edu.tr

Abstract

Poverty is a persistent problem for most countries, including EU, the United States and developing countries. This study is about the role of education opportunities in the "vicious circle of poverty" in Turkey, which has been considered a fundamental problem in recent decades. We first build a system dynamics model of the interactions between the working poor and education opportunities. The main question is whether the poor will remain poor in successive generations, or if there can be upper intergenerational socioeconomic mobility among the poor. Secondly, the model seeks to examine some educational policies aimed at combating working poverty. The rise in privatized education is a key factor in the study since it directly influences the (in)equality in education opportunity. A high quality education is a pre-condition to acquire a high-skilled job. There are huge discrepancies in the quality of education in Turkey. As a consequence, unemployment and unskilled employment have been a persistent problem. The results of the model show that inequality in education opportunity can make it impossible for the poor to access high-quality education, hence suppressing the opportunity to have highly paid jobs. Finally, the study investigates some educational policies that may help breaking this vicious cycle.

Keywords: system dynamics, vicious circle of poverty, privatized education, inequality in education opportunity, unemployment

1. Introduction

Poverty is a major socioeconomic problem all over the world, which has been qualitatively and quantitatively associated with various actors; such as the unemployed, unskilled, retired, socially-excluded and homeless (Pena-Casa & Latta, 2004). For a long time, increasing labor qualifications have generally been considered an effective way to solve the poverty trap (European Foundation for the Improvement of Living and Working Conditions, 2002). Yet, this has not been the case with rises in atypical work patterns, and a growing polarization in the labor market between unskilled jobs and highly skilled jobs, which have created new poverty risks among the employed population (Pena-Casa & Latta, 2004). As a result of this trend, the concept of "working poor", which has risen in the United States since the 1970s and 1980s, has become relevant also for social and labor market realities within Turkey and the European Union (Buğra & Keyder, 2005). According to TURKSTAT, the term "working poor" defines working households that are in a situation of financial poverty, which stands for being below the 50% of the median value of household disposable income. It is increasingly difficult for individuals who are essentially low skilled, from staying competitive in the rapidly evolving demands of the current labor market (Pena-Casa & Latta, 2004).

Poverty is a circumstance of complex relations between economic and employment factors, as well as social and financial policies at national and regional levels. It would be helpful to consult Amartya Sen's definition of poverty. He introduced a new insight to the literature, which points out the multidimensional capability deprivations for the poor; such as lack of access to public health and education services, or to public transportation, social services etc. (Sen, 1999).

As in Turkey's labor market, obtaining and maintaining a proper job requires a constant updating of skills. It is also increasingly difficult to obtain high-quality education in the reality of privatization. In Turkey, educational attainment and the income level of a student's parents have a large impact on the quality of education that a student receives. High-income families are able to pay for private teaching institutions and tutors, and this leads to inequality of opportunity in high school and university entrance examinations that tend to harsh competition (Aslankurt, 2013).

The main hypothesis in this study then, is that having a low paying job leads to being, becoming or staying a member of the working poor particularly for those born into a low-income family; especially in the presence of inequality of access to education opportunity due to the privatized educational institutions. Education opportunities' effect on employment has persisted for a long time. David Card states: "Education plays a central role in modern labor markets. Hundreds of

studies in many different countries and time periods have confirmed that better-educated individuals earn higher salaries, experience less unemployment, and work in more prestigious occupations than their less-educated counterparts" (Card, 1999).

The sub-questions behind the hypothesis are; "Is there indeed a vicious poverty cycle?" and "If there is; is there any way to break the cycle?" (Bauer, 1965) Ragnar Nurkse introduced this socio-economic problem as "the vicious circle of poverty". He claims, "A country is poor because it is poor." (Nurkse, 1953) It could be converted to micro level by considering a person or family. Questions like "Is a person is poor and will remain so because his family is poor?" or "Is a person rich because her family is rich?" apply to such problems.

To investigate these questions, system dynamics modeling is applied. As Sen defined, "capability deprivation for poor" is a multidimensional problem. Naturally, not all dimensions of this problem can be included in the system dynamics model because of the model scope. So, the main dimension for the model is the access to education services in this study. The model is constructed to address causal relations between the inequality in education opportunity and qualified employment potential.

The unemployment ratio, which is the ratio of unemployed people within the labor force, is useful to reveal the effect of poverty in the labor market. As it is seen in Figure 1.1, the unemployment ratio in Turkey is higher than the OECD average (OECD, 2014). Also, the difference between unemployment ratios for the poor and the rich is important to understand the dynamics of the poverty cycle, as will be seen below. Furthermore, the gap between the annual average salaries of the poor and the rich is critical for evaluating the poverty cycle (see Figure Table 3.1).
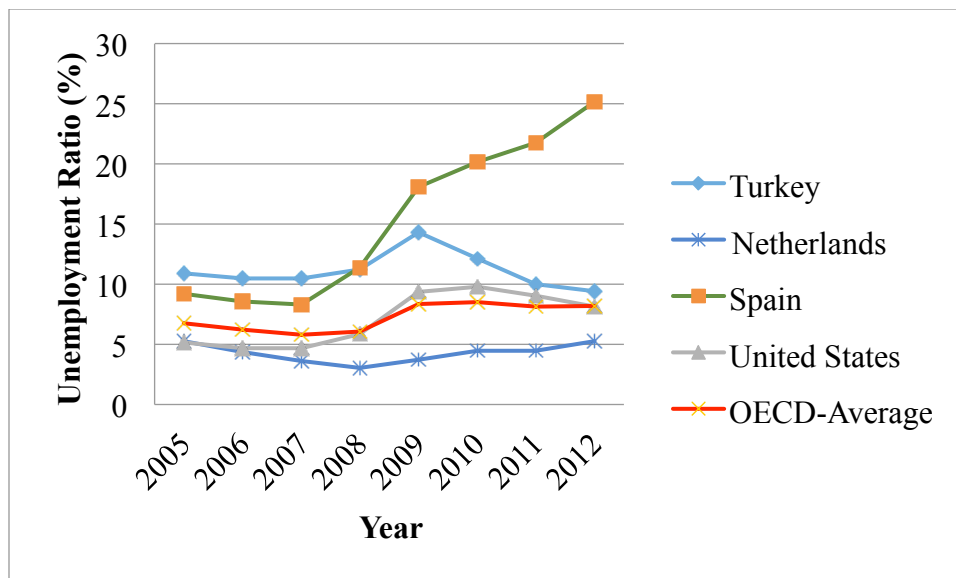

Figure 1.1. Unemployment ratios in some selected OECD countries for 2005 to 2012 (OECD, 2014).

2. Research Objectives and Model Overview

The work of Joao Cesar das Neves (1988) uses systemic analysis to the original theories for poor stagnant economies, which is also called the poverty equilibrium. The works of Ragnar Nurkse, Gunnar Myrdal, John K. Galbraith and Harvey Leibenstein are components of a general theory of stagnation at low income (Neves, 1988). There is a related term to "the vicious circle of poverty" in the literature, which is "intergenerationality". This term means that interactions between members of different generations impact each other. Additionally, intergenerational mobility refers to a measure of the changes in social status, which occurs between the financial mobility of parents' to their children's generations.

There are some modeling examples of poverty trap in system dynamics literature with macroeconomic view and debt accumulation (Hosseinichimeh, 2008), (Ansah, 2010). However, the contribution of Neves's paper to the literature was stimulating for our modeling study. We introduce a system dynamics model about selected aspects of "the vicious circle of poverty". Specifically, the main focus is to investigate the relationship between poverty and education opportunity. Inequality in access to education opportunity stems from socioeconomic status. Two main socioeconomic groups, who belong to the low and high levels of income, are presented in this study: The poor and the rich. Their socioeconomic and education backgrounds are different; the rich has significantly higher living standards than the poor has.

Our study aims to model the feedback dynamics between poverty and education opportunity to understand whether there can be an upper intergenerational socioeconomic mobility among the poor. Education is one of the factors, which determines the quality of human capital (The World Bank Group Education Strategy, 2011). A high-quality education is critical for a child who is born into a low-income family, in order for that child to be able to eventually shift to a higher level of income then the one they were born into. In other words, education is a major tool for generating intergenerational social mobility (Aslankurt, 2013). When a child receives a high-quality education and is enabled to become a member of a highly skilled labor force, this also means that s/he will likely receive a higher income.

Building a proper and credible system dynamics model to understand the feedback dynamics between poverty and education opportunity is the first goal of this study. A second goal is to use the model for analyzing the effects of social policy proposals in the long run in Turkey. In order to understand the dynamic behaviors of intergenerational mobility under different social policy proposals, the gap between salaries of the poor and the rich are evaluated.

The model consists of two main sectors. The first one is the population-education sector which is concerned with the aging of poor and rich populations separately; and the second one is concerned with the employment sector which consists of salaried labor force population and employment market. Population among poor and rich is divided into four age groups, which are 0-14-year-old children, 15-24-year-old students, 25-54-year-old labor force and older than 55-year-old retired people. Students can receive two different types of education, called high quality and low-to-average education. According to students' quality of education, they acquire a related skill level in the labor force. If students receive high-quality education, they are able to join a

highly skilled labor force, and if students receive low-to-average quality education, they join a semi-skilled labor force. On the other hand, if they drop out of school, they directly join unskilled labor force. In the employment sector, there are three different levels of jobs. Highly skilled, semi-skilled and unskilled job levels are represented; along with the respective number of available jobs per level.

A simplified causal loop diagram is given in Figure 2.1. For the sake of simplicity, the logic behind the causal relationships between education background and skill level are given together for both the poor and the rich. When a person has a high-quality education, it increases the chance to secure a highly skilled job, which indicates having a higher salary. Increases in annual average salary also facilitate the affordability of high-quality education. According to this, if there is an increase in privatization in high-quality education, rich have higher chance to afford highly qualified education. Again, receiving high-quality education increases the chance to secure a high skilled job, which means having higher salary. This feedback loop is called "privatization pressure by rich" in the causal loop diagram.

On the other hand, if there is an increase in privatization in high-quality education, a person with low level of salary cannot afford high-quality education, so, the person receives a low-to-average quality education. This person will then likely get a low skilled job level, which results in having a low salary. This feedback loop is named "low quality education to low qualified employment for poor" in the model.
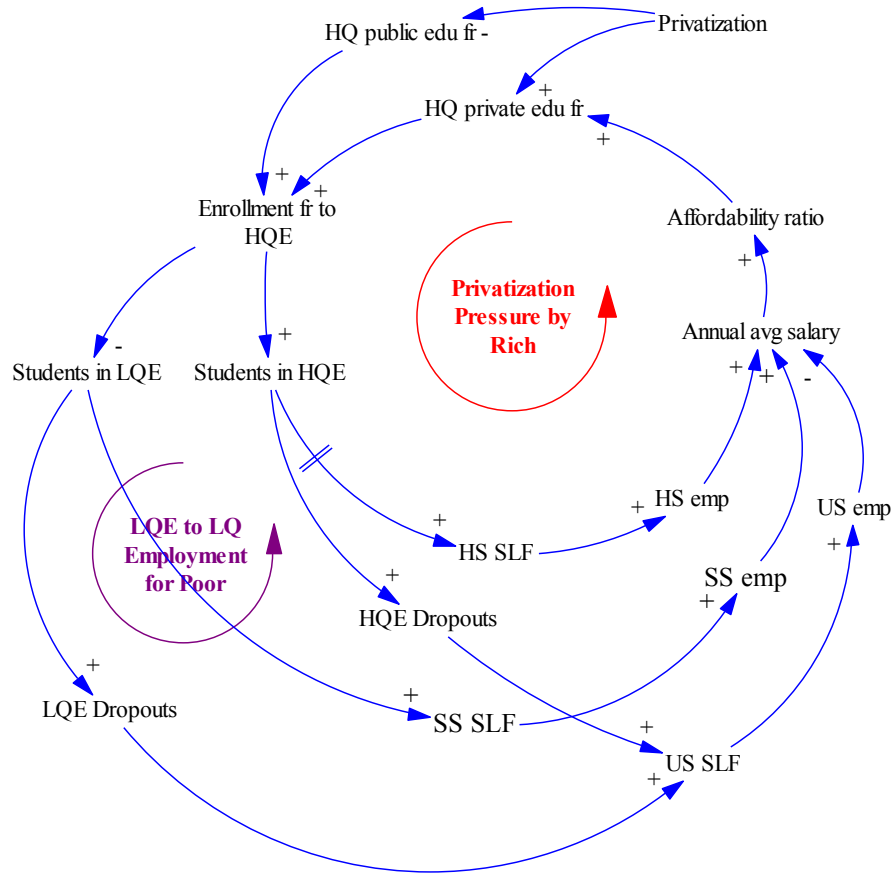
Figure 2.1. Simplified causal loop diagram of the model.

3. Description of the Model

3.1. Population – Education Sector

The relevant parts of the demographics of Turkey's population are modeled in the population sector. This sector is divided to two subpopulations, which are designated as poor and rich, corresponding to low and high-income level of household, respectively. For modeling population dynamics, there is a modified aging chain process reflecting people's education periods and labor force stages (Figure 3.2 and 3.3).

The hypothesis of this study is that the annual average salary of the rich is about two times higher than that of the poor's annual average salary. According to this hypothesis, half of the first quintile and the second quintile in Table 3.1 are summed up as the percentage of the poor population. Therefore, 30% of the population is the poor in the model. On the other hand, the fourth quintile is defined as the rich in the model so, 20% of the population is rich in the model. Thus, in total half of the Turkey's population is represented in the model; the other 50% of

population, consisting of extreme poor, the middle class, and extreme rich that are not critical for the purpose of the study.

Table 3.1 Distribution of annual equivalised household disposable incomes by quintiles ordered by equivalised household disposable income, 2011-2012 (Turkish Statistical Institute, 2012).

		Year	Percentage (%)	Avg income (TL)	Median income (TL)
Quintiles	1st 20%	2011	5.8	3 129	3 247
		2012	5.9	3 468	3 619
	2nd 20%	2011	10.6	5 698	5 692
		2012	10.6	6 301	6 294
	3rd 20%	2011	15.2	8 178	8 139
		2012	15.3	9 055	9 030
	4th 20%	2011	21.7	11 693	11 533
		2012	21.7	12 850	12 772
	5th 20%	2011	46.7	25 172	20 039
		2012	46.6	27 624	22 042
	Total 100%	2011	100.0	10 744	8 139
		2012	100.0	11 859	9 030

Even though modeling of aging chains among the poor and the rich population is similar; their respective net birth rates of population are different. Calculations based on the "Income and Living Conditions Survey" (ILCS, 2009) indicate that the average number of children per household in low-income households is higher than in high-income households (Acar, 2012). An average number of children per household by 5% income brackets is shown in Figure 3.1. Average number of children per household is 1 in the highest-income group and 3.5 in the lowest-income group.

According to TURKSTAT's ILCS (ILCS, 2009) average number of children per poor household is 2.5 in the first and a half quintiles; whereas the average number of children per rich household in the fourth quintile is 1.5 (Acar, 2012), (Turkish Statistical Institute, 2012). For our model, this means the average number of children per poor is 1.7 times the rich's average number of children. This comparison of average number of children per poor and rich household drives the difference between net annual birth fractions of the poor and the rich. So, we approximately take the net birth fraction of the poor to be two times the rich's net birth fraction. Also, according to TURKSTAT's population projection data (Turkish Statistical Institute, 2013), we calculate the net annual birth fractions of the poor and the rich.
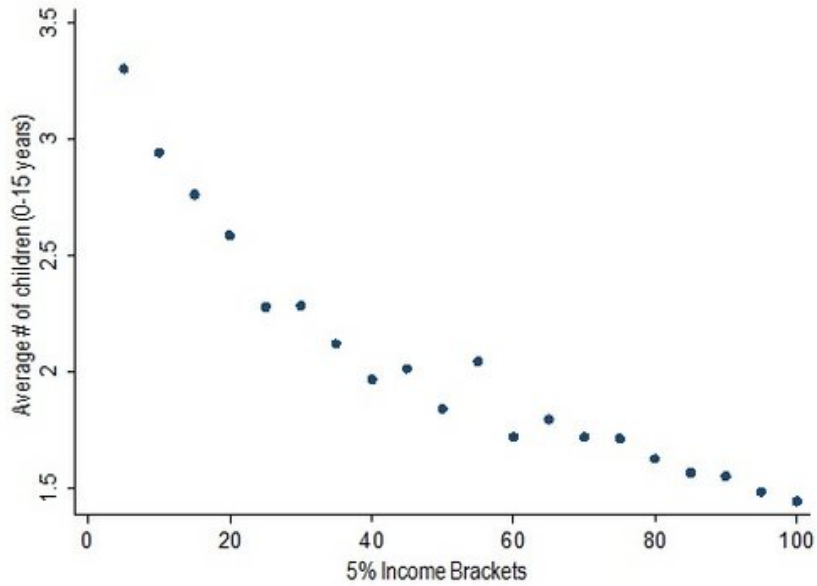
Figure 3.1. Average number of children per household by 5% income brackets (Acar, 2012).

The formal educational system in Turkey consists of eight years of primary schooling, three or four years of high schooling and tertiary levels of schooling. For our purpose, we use two stages of education in our model (Figures 3.2 & 3.3): Primary and lower secondary levels of education are represented as the first stage of education. Then, upper secondary and tertiary levels of education are counted as the second stage of education where students spend 10 years on average in high school till university graduation. The quality of education is categorized in two levels: high-quality education and low-to-average quality education. The concepts of high and low-to-average quality education apply to upper secondary and tertiary education. There are different types of private and public high schools in Turkey. All of the public Science High Schools, some of the private Science High Schools, and some other highly selective public and private High Schools are counted as high schools of high-quality education. Students from these schools perform the best in university entrance examinations. Therefore, there is a link between receiving a qualified education in high school and university. Furthermore, there are both public and private universities in Turkey. All universities select their students based on a national university entrance examination, which is held once in a year.

For classifying quality of education in universities, a University Index, which is conducted by TUBITAK, is consulted (TUBITAK, 2013). The most successful public and private fifteen universities among some fifty universities are counted as universities in the high-quality education for this study. Low-to-average quality education refers to the other universities, not included in these fifteen. Note that "low quality" education represents "not high quality" (i.e. "low-to-average") education in this study.

In Turkey, educational attainment and income level of parents have a large impact on the quality of education students receive. High-income families are able to pay for private teaching institutions and tutors, which leads to an inequality of opportunity in high school and university entrance examinations, which are already in harsh competition (Aslankurt, 2013). In the model,

if students can receive high-quality education, it indicates that they are likely to join a highly skilled labor force. On the other hand, if they receive low-to-average quality education, they tend to join a semi-skilled labor force. Some students drop out of school, so they immediately become a part of the unskilled labor force. In short, labor force statuses are categorized in three levels: highly skilled, semi-skilled and unskilled labor force (see Figures 3.2 & 3.3). After a working life period, people are counted as retired people until they die.
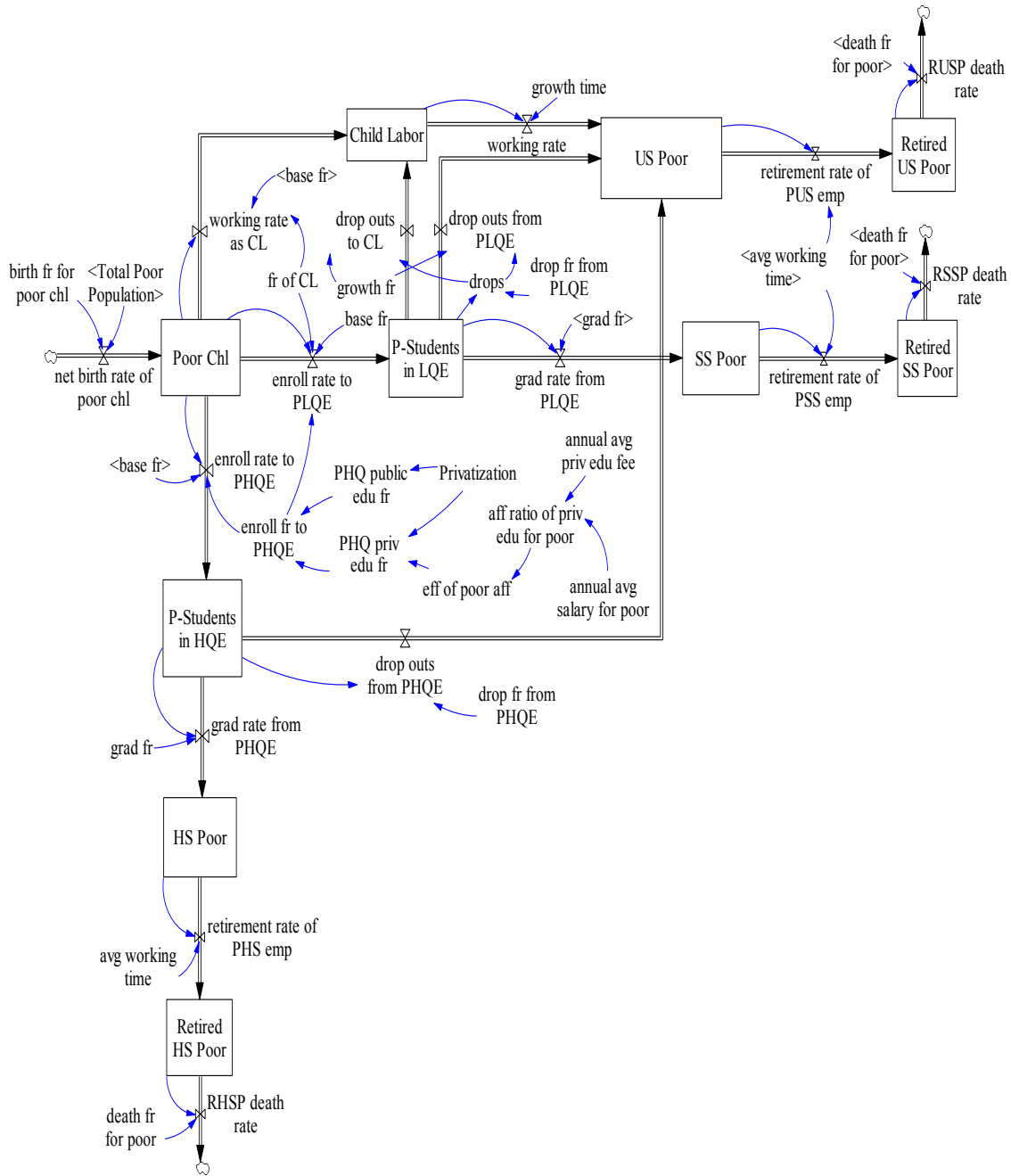
Figure 3.2. Stock-flow diagram of the population-education sector among the poor.
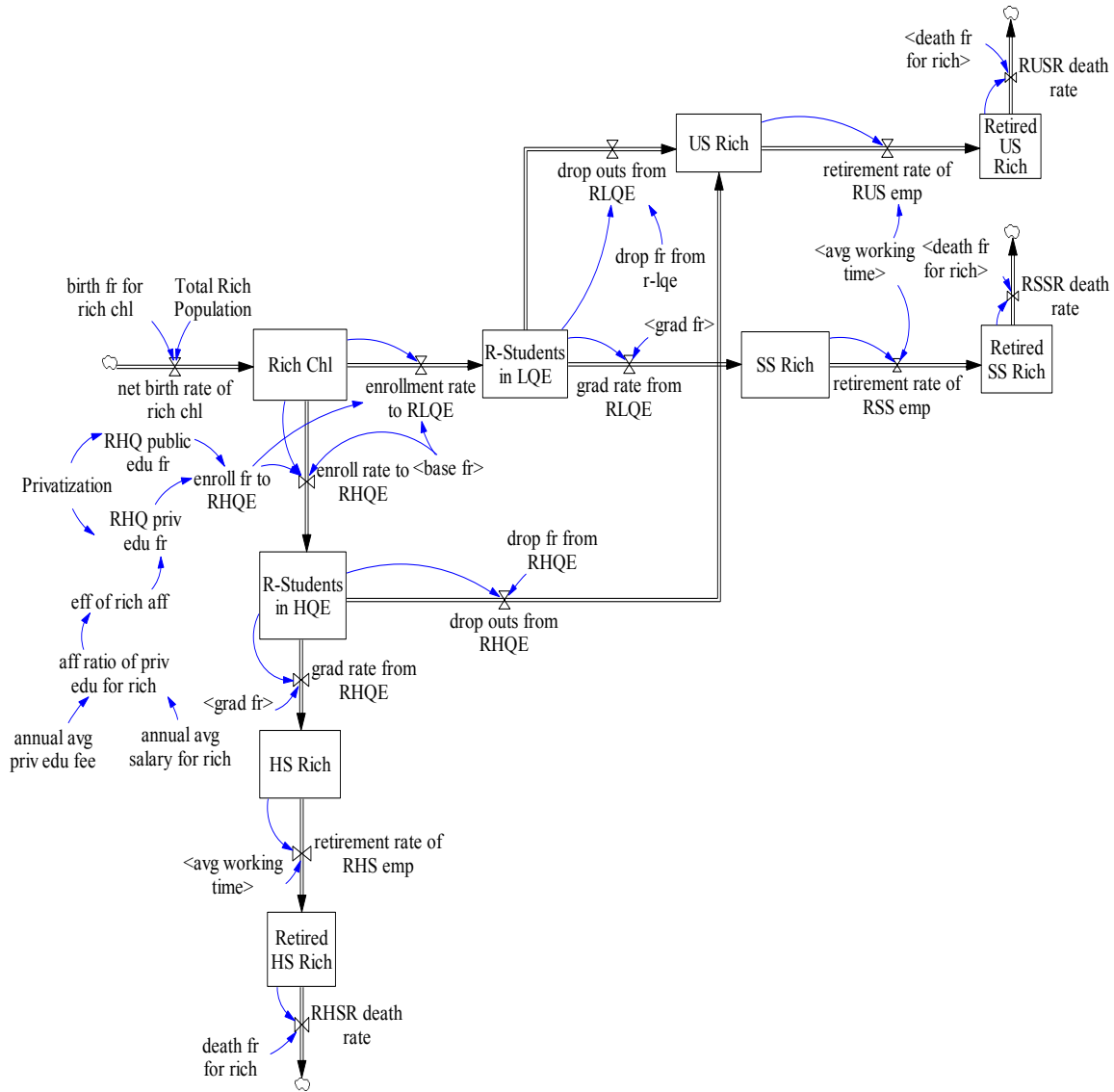
Figure 3.3. Stock-flow diagram of the population-education sector among the rich.

In the aging chain there is a base fraction that implies a 15-year period for child maturity. After children become 15 years old, they can enroll in low-to-average or high-quality education. At this point, there is an enrollment fraction to high-quality education, which is needed for the enrollment rate to high-quality education (and low-to-average quality education). These rates are affected by privatization and affordability of education fees. Whether it is in privatized or public education, high-quality education is not an ordinary achievement. Therefore, two base fractions are introduced in the model for high-quality public and private education. The high-quality public education base fraction refers to students' entrance rate to high-quality public schools under normal conditions. With the same logic, a high-quality private education base fraction indicates students' entrance rate to high-quality education in private schools under normal

conditions. Due to the difference between poor and rich students' background, the high-quality private education base fraction for the rich is higher than it is for the poor. It is known that; if there is an increase in privatization, then the rich could afford the increased private capacities much more easily than the poor could. For that reason, there is an effect of affordability on privatized education for the high-quality private education fraction. In addition, this effect on the high-quality private education fraction also has an influence on the enrollment fraction to high-quality education.

3.2. Employment Sector

When the education period ends for students, they join the labor force according to their qualifications. The difference between labor force qualifications comes from their educational backgrounds. As mentioned before, if students receive high-quality education, they then join a highly skilled labor force. If they receive low-to-average quality education, they then join a semi-skilled labor force. Students may drop out of school during their education period, and then they join the unskilled labor force. Therefore, there are three levels of labor force: highly skilled, semi-skilled and unskilled. (People in reality can work as employees, employers, own-accounts or be contributing family workers. Since the model deals with poverty dynamics among the working poor, only the salaried labor force is taken into account).

The simplified diagram of the employment sector is in Figure 3.4. There is one stock to represent the number of available total jobs in this sector. Number of total available jobs changes by the net growth rate of the labor force in the base run. The total jobs are then divided into high skilled, semi-skilled and unskilled jobs, by using respective fractions obtained from Turkish data. The rest of the employment sector consists of equations that allocate three categories of labor force (high skilled, semi-skilled and unskilled) to three categories of jobs. In the base model, there is a vertical employment hierarchy in the hiring process. In other words, a person among the higher-level labor force is unemployed, s/he has priority to get a lower level jobs. For instance, if there is a highly skilled person who is unemployed because of insufficient highly skilled jobs, s/he has priority to get a semi-skilled job over a semi-skilled person. This 'vertical' employment rule is later changed in some scenarios, as explained below.
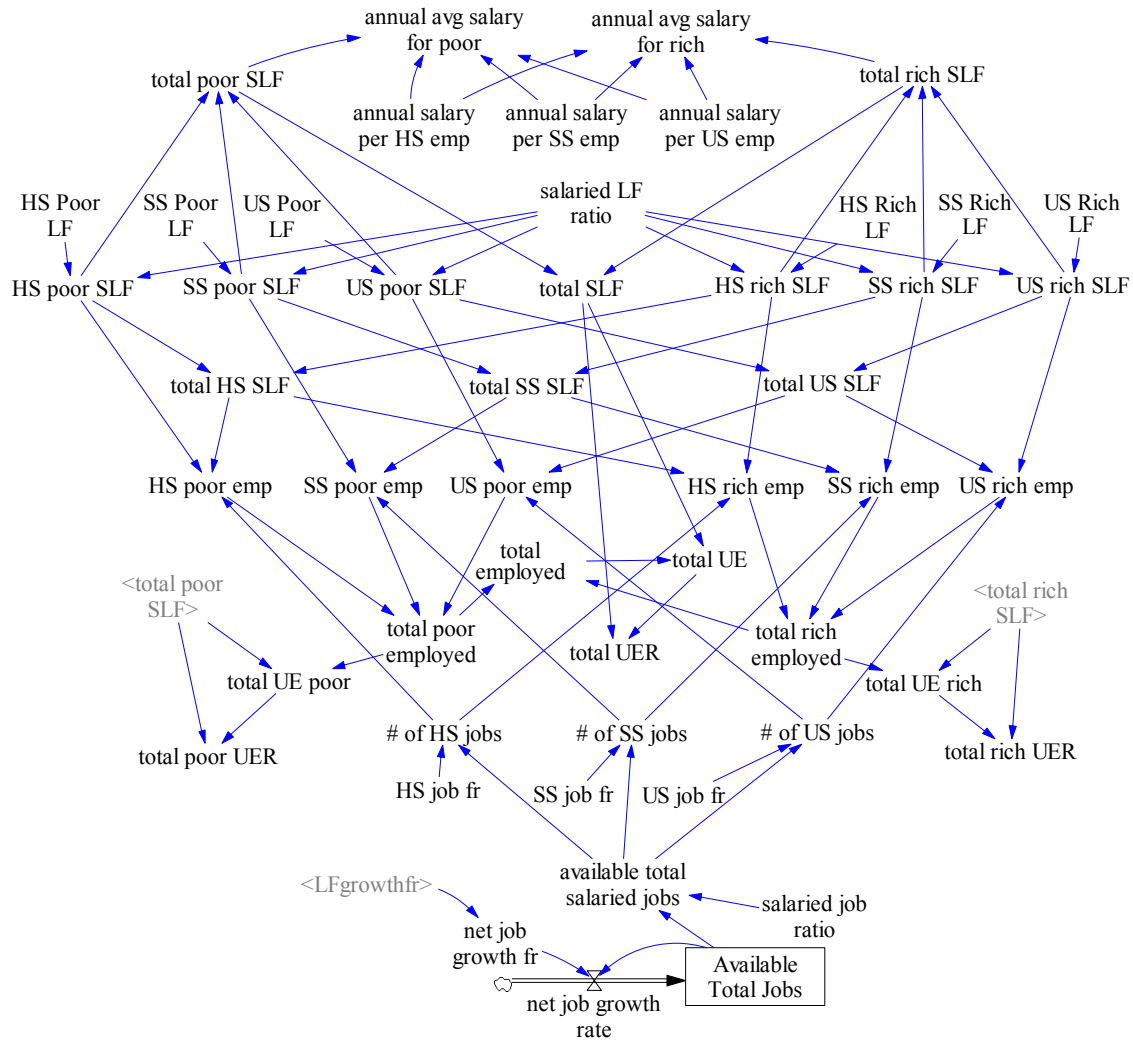
Figure 3.4. Diagram of the employment sector.

4. Credibility and Analysis of the Model

The model is simulated by Vensim. It is a continuous time model and the time step is selected as 0.125. This value is neither too large to give inaccurate results, nor too small to cause computer calculation problems. The time unit of the model is one year. The time horizon of the simulations is set to 77 years, from 2013 to 2090 in order to be long enough to represent a couple of generations. Also, the horizon is proper to capture for the direct, indirect, and delayed effects of the variables and feedbacks.

The model verification and direct model validation are conducted. Also, extreme condition tests are done; no problematic results are observed. After the structural tests, behavior credibility tests are conducted to check if the model's dynamic patterns are close enough to the real patterns of concern. For this test, TURKSTAT's projection data is referred. All the tests are in tune with real projections, qualitatively and quantitatively (Bacaksızlar, 2014).

4.1. Analysis of the Base Behavior

The base model is a reference for comparison and evaluation of the scenarios and policies. There is a smooth increase in the privatization ratio, which has an influence on the number of students in high-quality education. The ratios of number of poor students in high-quality education, among all poor students, and the ratio of number of rich students in high-quality education, among all rich students, are compared in Figure 4.1. Rich students have a higher proportion than poor students' in high-quality education, among each students' population. On the other hand, the ratio of number of poor students in low-to-average quality education among all poor students and the ratio of number of rich students in low-to-average education among all rich students are compared in Figure 4.2. Poor students receive a higher proportion than rich students do in low-to-average quality education among each students' population.
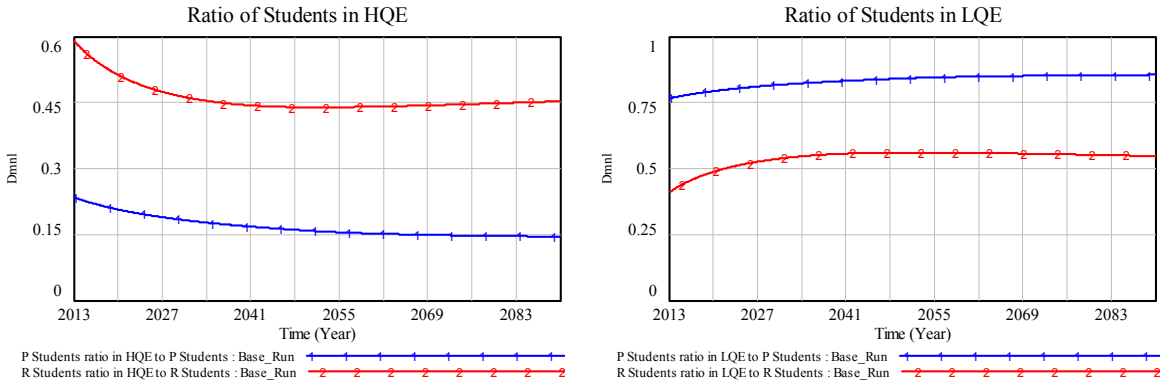

Figure 4.1 & 4.2. The ratio of students in HQE & LQE for the poor and rich in the base run.

The annual average salaries of poor and rich are provided in Figure 4.3. Also, the ratio of annual average salaries is given in Figure 4.4 to see the difference between them.
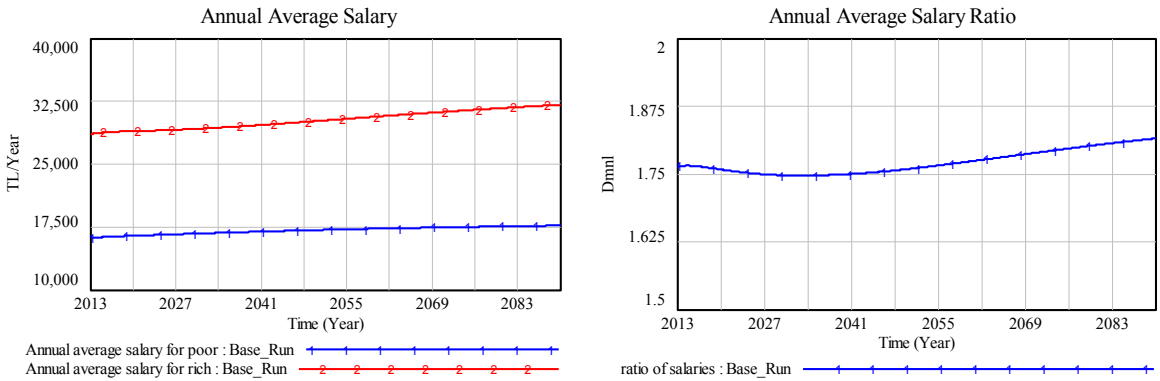

Figure 4.3 & 4.4. The annual average salaries and their ratio of the poor and rich in the base run.

For the employment sector, the number of the salaried labor force (SLF) with respect to all skill levels and the number of available salaried jobs for every branch are provided in the following figures. These figures display the employment market with the number of available salaried jobs for the related labor force.
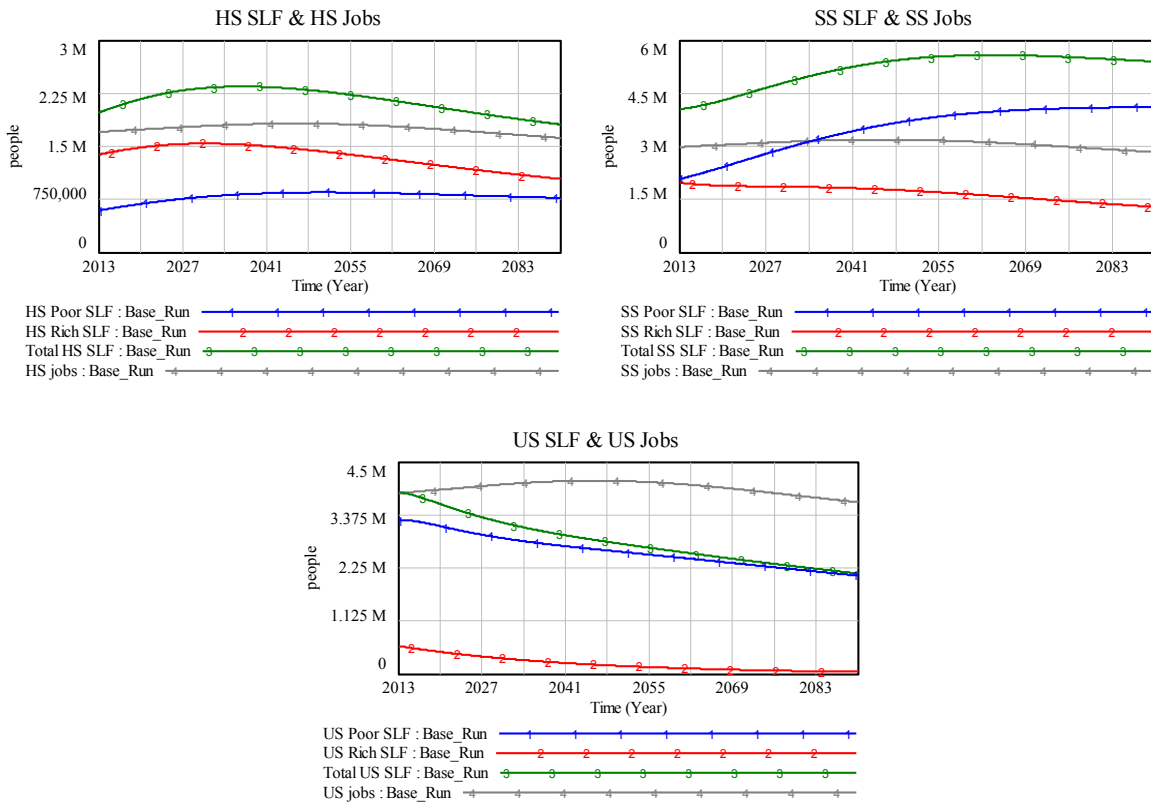

Figure 4.5, 4.6 & 4.7. Each skill levels of salaried labor force and jobs in the base run.

Total unemployment ratio for an employment sector is given with the total unemployment ratio for the poor and rich in Figure 4.8. The unemployment ratio among poor is higher than it is among the rich. It should be recalled that, in the base run, the algorithm behind the employment sector does not allow high skill workforce to be unemployed if there is room in the lower skill level jobs. In other words, if there is a highly skilled unemployed person, s/he gets the lower skilled job before the semi-skilled labor force does. So, semi-skilled jobs are first open to highly skilled unemployed people. Likewise, unskilled jobs are first open to semi-skilled unemployed people. Therefore, since semi-skilled and unskilled salaried labor forces among the poor are much higher than the ones among the rich, unemployed poor fraction is higher than rich people's.
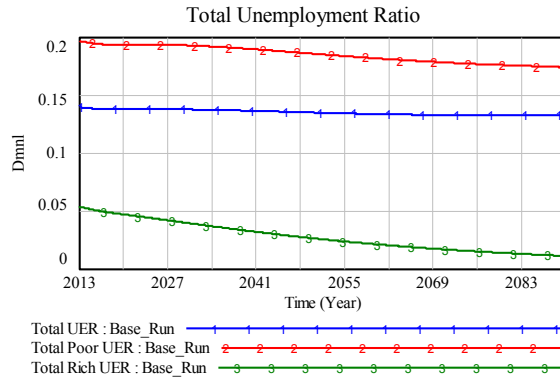
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Figure 4.8. All unemployment ratios in the base run.

5. Scenario and Policy Analysis
5.1. Scenario 1: Horizontal Employment Priority in Hiring Process

In the employment sector in the base run, there is a vertical employment hierarchy in the hiring process as described above. In Scenario 1, the hiring process uses a horizontal job hierarchy, which means all skill levels of the labor force first obtain their corresponding level of jobs. After all people at a certain skill level are placed, if there are free jobs left at this level, only then the unemployed people in the higher-level labor force can obtain these lower level jobs. The employment algorithm of the base run caused the higher level of labor force to be employed firstly, with high priority. Now, the new algorithm of this scenario causes all skill levels of the labor force employed more uniformly, if there are available jobs at respective levels.

The annual average salary of the rich in Scenario 1 is still significantly higher than the poor's salary. However, in this scenario, as shown in Figure 5.1, the annual average salary of the poor is higher than it is in the base run. To better compare, the annual average salary ratio is provided in Figure 5.2. There is still a gap between the poor and the rich's salaries, but this gap is smaller than it is in the base run.
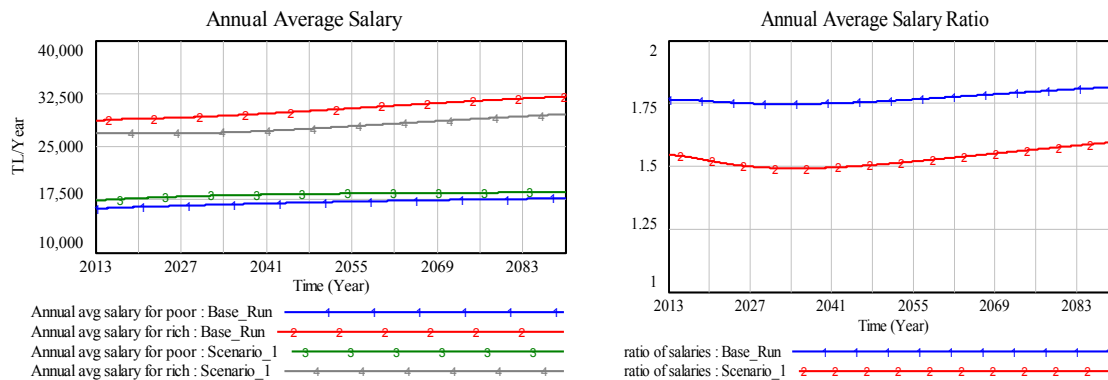

Figure 5.1 & 5.2. The annual average salaries and their ratio of the poor and rich under Scenario_1.

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With new algorithm where all skill levels of the labor force are employed uniformly, the total unemployment ratio of the rich becomes higher than the unemployment ratio of the poor (see Figure 5.3). There is a huge difference in the unemployment ratios between the base run and the first scenario. In the base run, the unemployment ratio of the poor is almost four times higher than the unemployment ratio of the rich (see Figure 5.4). However, in this scenario, the unemployment ratio of the rich is significantly higher than the poor's unemployment ratio.
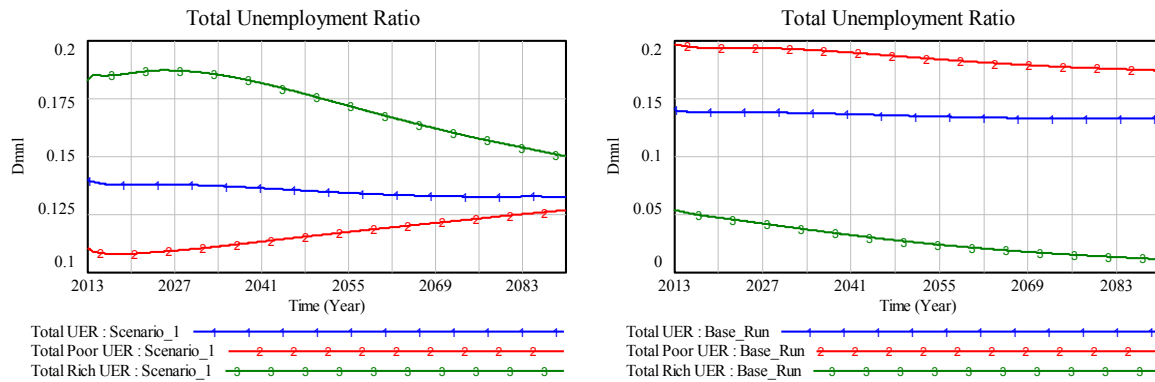

Figure 5.3 & 5.4. All unemployment ratios under Scenario_1 and in the base run.

The reason behind this huge difference among unemployment ratios is the change in the hiring process. Highly skilled people become unemployed, since there are not enough high-skill jobs in the market and there is no place for them in semi-skilled jobs. (According to new hiring algorithm, highly skilled unemployed people do not apply for unskilled jobs, and/or they are not preferred by employers of semi/unskilled jobs.)

5.2. Scenario 2: Increase in Net Job Growth Rate

In order to decrease the unemployment ratio, there has been debate on creating jobs for employment market (Yunus, 2008). In this scenario, the annual net job growth fraction is increased by 20% of its base value (which was assumed to be equal to the growth fraction of labor force).

There is a decrease in all unemployment ratios until around 2050; after that, the unemployment ratios of the poor and the total population start to increase (see Figure 5.5). However, in the base behavior, the unemployment ratio of the total populations is constant, and the ratio of the poor decreases (Figure 5.6).
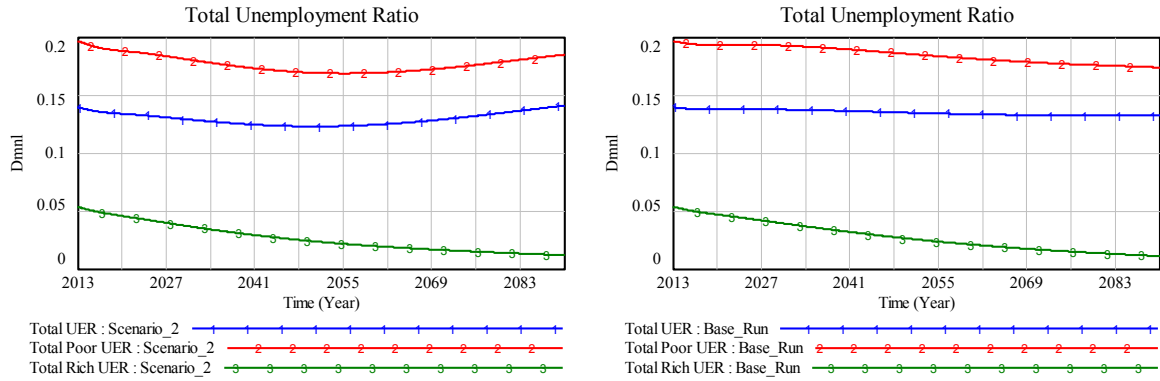
Figure 5.5 & 5.6. All unemployment ratios under Scenario_2 and in the base run.

There is no difference in annual average salaries compared to the base run (Figure 5.7). The gap between the annual average salaries of the poor and rich is still a concern.
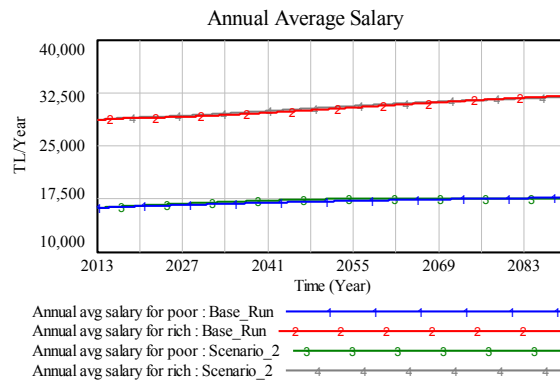

Figure 5.7. The annual average salaries of the poor and rich under Scenario_2.

5.3. Policy_1: Quota Proposal for the Poor in Privatized Education and Funding for Privatized Education Fees for the Poor

In the first policy, the funding for privatized education fees for the poor is analyzed with quota proposals for the poor. The quota proposals are like a privilege for the poor, in order to increase their chances to obtain high-quality education. In addition to the quota proposal, the funding for the privatized education fees to the poor is assumed to be 50% of annual average privatized education fees in 2023. (Figure 5.8)
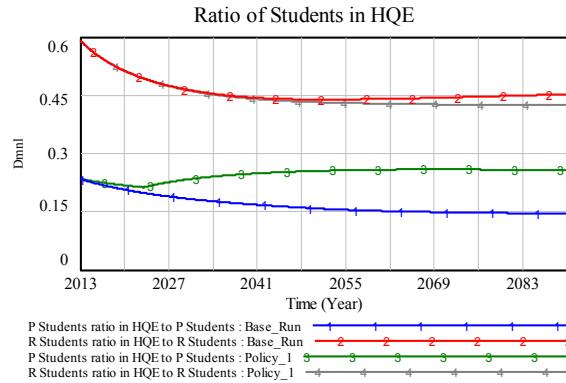
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Figure 5.8. The ratio of students in HQE for the poor and rich under Policy_1.

According to this policy results, there is an increase in the highly skilled salaried labor force among the poor, but this increase does not lead to significant increase in the annual average salary of the poor (see Figure 5.9 & 5.10). The gap between their salaries starts to decrease after about 2023, since there is an increase in the highly skilled poor salaried labor force, who shares the highly skilled employment market with the rich. However, there is a bottleneck of the high-skilled jobs for the highly skilled salaried labor force. Therefore, they get the semi-skilled jobs instead of being unemployed.

As explained before, the number of total salaried labor force among the poor is higher than the rich's salaried labor force. According to this, the increase in annual average salary of the poor is slight due to the denominator of the annual average salary formulation. So the increase in the annual average salary of the poor is not very significant due to the number of total poor salaried labor force.
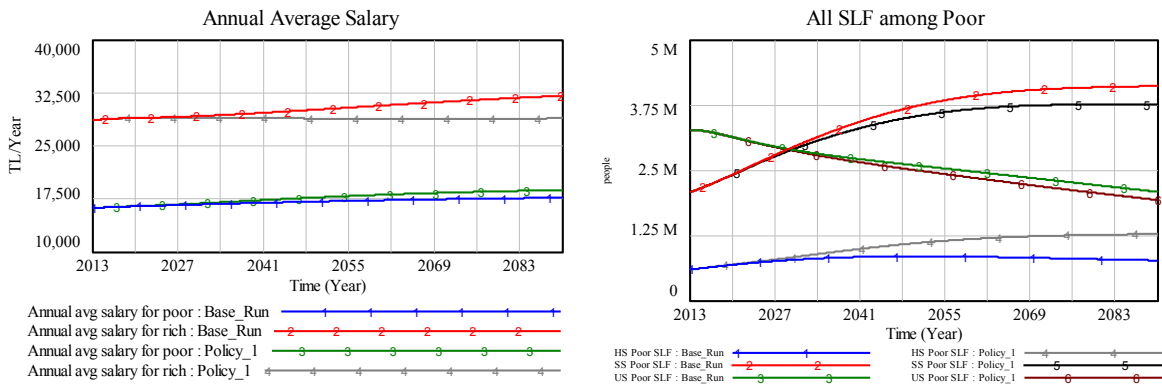

Figure 5.9 & 5.10. The annual average salaries of the poor and rich and all SLF among the poor under Policy_1.

5.4. Policy_2: Quota Proposal for the Poor in Privatized Education, Funding for Privatized Education Fees, and New Jobs for the Poor

According to the results of the first scenario and policy, poor cannot break the cycle of poverty just with more access to education opportunities. In addition, the unemployment ratio of the poor is persistent in most of the policy experiments. There is a need to apply enhanced policies, aimed to alleviate poverty with also increased employment among the poor. There could be education policies that are also proposed along with the improvement in the employment market among the poor. Therefore, another policy is suggested to this problem of stagnation at low level of the poor's annual average salary. For this policy analysis, the quota proposal and funding for privatized education to the poor are applied with an increase in jobs for poor.

With the help of this policy, the highly skilled salaried labor force population increases compared to the base run (Figure 5.11). On the other hand, there is no change in the rich's salaried labor force market, as expected (Figure 5.12).
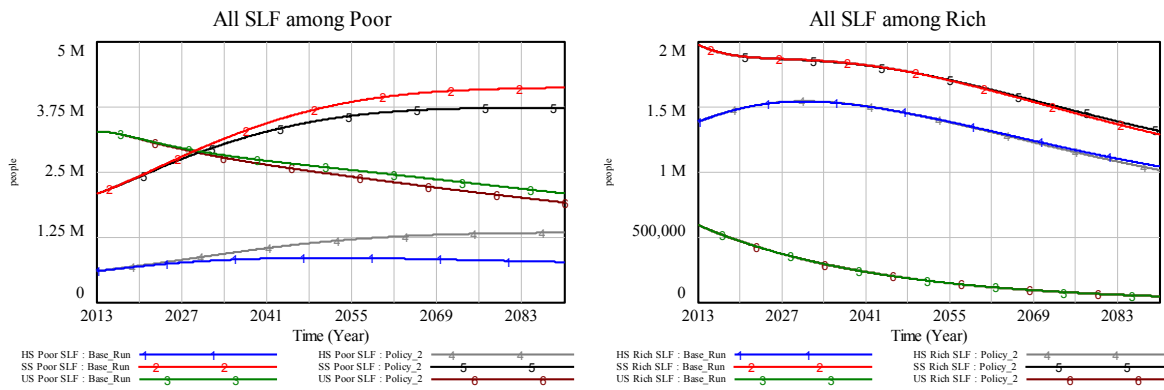

Figure 5.11 & 5.12. All SLF among the poor and the rich under Policy_2.

According to the results of this policy, there is an increase in the annual average salary of the poor compared to the base run and also to the Policy_1 (Figure 5.13). The gap between the annual average salary of the poor and rich decreases after 2023 (Figure 5.14). Although the gap between their salaries decreases increasingly, this does not imply that the poverty cycle is completely broken for the poor. The decrease in this gap is also a partial result of the decrease in the rich's annual average salary, since there is a competition between the poor and rich's hiring in employment sector.
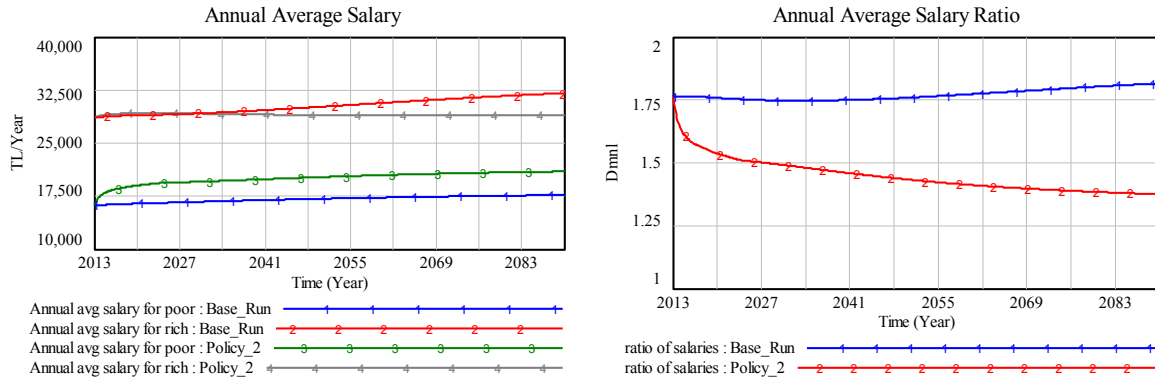
Figure 5.13 & 5.14. The annual average salaries and their ratio of the poor and rich under Policy_2.

Here, the total and poor unemployment ratios decrease due to the increase in jobs for the poor. Although the unemployment ratio of poor is higher than the rich's unemployment ratio, it is at significantly low level compared to the base run (see Figure 5.15 & 5.16).
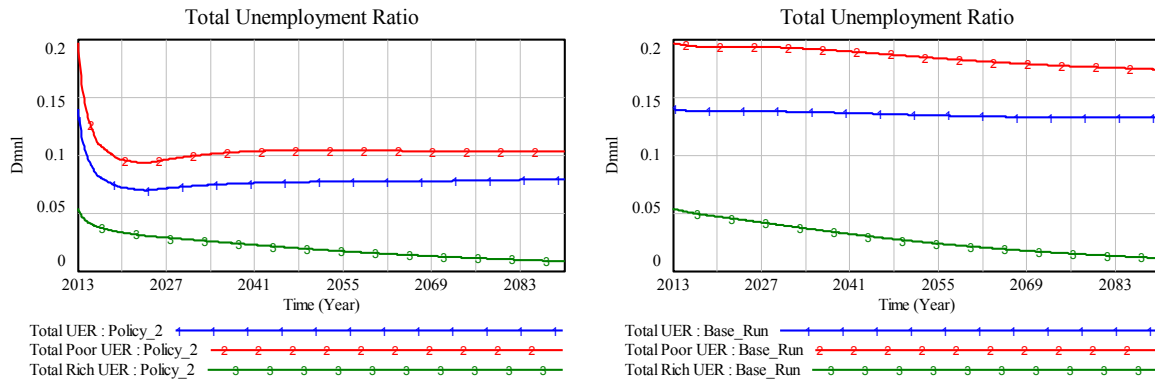

Figure 5.15 & 5.16. All unemployment ratios under Policy_2 and in the base run.

6. Conclusion

In this study we first build a system dynamics model for a particular form of poverty resulting from interactions between two fundamental structures in Turkey: Unequal access to education due to privatization, and a growing polarization in the labor market between *unskilled* or *semi-skilled* and *highly skilled* jobs. Next, the model seeks to examine some policy options aimed at combating the above 'working poverty' (working people with very low salaries).

Equal opportunity to access high quality education is necessary for high job skills. Lack of equal access to high quality education can potentially play a major role in causing a vicious circle of poverty over successive generations of poor families. Thus, the model is also deployed to

answer an essential policy question: Is it possible to have a break in the poverty cycle in a couple of generations?

The constructed model is first tested by a series of structural and behavioral credibility tests. At the end, it is shown that the credibility of the model is adequate. Subsequent results of the scenario and policy experiments show that there is not a significant change in annual average salary of the poor; except in policies where there is a radical quota in private education for the poor and funding for their private education fees.

The poor unemployment ratio is also higher than the unemployment ratio of the rich in most scenarios. There can be different behaviors of the unemployment ratios with different hiring approaches in the employment sector: For instance, Scenario 1 assumes a 'horizontal hiring' rule. In other words, all skill levels of the labor force first secure all jobs at their respective levels, which is opposite of how hiring is done is in the base run (where a high skill employee has higher priority if s/he applies for a job at a lower qualification level). The horizontal employment hierarchy changes the dynamics of the unemployment ratios such that the unemployment ratio of the rich becomes higher than the poor's unemployment ratio. However, the primary concern still exists; there is a stagnation for the poor at a low level of annual average salary.

In some policies, even if there is an increase in quota in high-quality education for the poor, the annual average salary of the poor stagnates at low levels. Increasing only the net job growth rate does not yield a solution to the poverty cycle either. There may be decreases in the unemployment ratio of poor, but their annual average salary still stays much lower than it is for the rich. The policy that reserves quota (50%) for the poor in privatized education and funding (50%) for education fees for the poor does have noteworthy effect on reducing the salary gap. Finally, a radical policy that significantly increases the average salary of the poor (hence substantially reduces the salary gap) is: 'quota (50%) for the poor in privatized education, funding (50%) for education fees for the poor, and new jobs (10%) reserved for the poor'.

The results of the simulation experiments clearly show that the risk of vicious circle of working poverty is significant. There is a strong inertia of the stagnation at low income for poor families. It is very hard to change their annual average salary significantly in a couple of generations. This is in part caused by an economic problem initially, that is the initial inequality in income distribution. It sends a clear message to policy makers; besides the increase in net job growth rate, equalizing education opportunities is one of the key necessities for combating working poverty. Notably, with the increase in education opportunities, there is a decrease in annual average salary of the rich, in addition to an increase in the average salary of the poor. This is because of increased competition in the highly skilled labor forces market. Interestingly, this side effect of poor-oriented policies on the rich salaries is stronger than its effect on poor salaries in most cases.

Governments strive to enable better education for their citizens (Yıldırım, 2013). The inequality in education opportunity must be addressed by social policy arrangements in Turkey. The equality of education opportunities means that offering high-quality knowledge and skills in

schools irrespective of socioeconomic level, making sure those individuals from disadvantaged backgrounds have access to high quality schools (Glewwe, 2002). The model shows in its boundary that there is a very weak chance for intergenerational socioeconomic upward mobility without strong measures for equality of opportunity in education.

According to the simulation results, using a single policy instrument to alleviate poverty is not sufficient; integrated, multi-dimensional policies have a much better chance of success. There should be not only social assistance programs, but also opportunities providing education and training support which leads to increase in productivity, and therefore earnings. These policies should be applied in a coordinated way.

As future research, job growth rate in the model could be affected by changes in the labor market with regard to the endogenous macroeconomic growth theory. Also, entrepreneurs and employers may be included in the labor market segment of the model, again influencing economic growth. Mobility between the poor and rich families, in other words movements at the higher skill levels, could be included in the model. Moreover the birth fractions of the poor and rich and also their enrollment fractions to public high-quality education could be endogenously affected by their annual average salaries in an enhanced model. Finally, adding a taxation process and a government budget for education expenses would enrich the applicability of the model, whereby there may be different taxation regulations/policies for education expenses for the poor and rich. Scenarios about inequality in income distribution, and policies on the redistribution of income may also be tested in an enhanced version of the model.

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